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Principles Affecting the Reproductive Functions*

DISCUSSION BY THE CENTRAL VETERINARY SOCIETY

OPENING ADDRESS BY DR. JOHN HAMMOND

Dr. JOHN HAMMOND, F.R.S., of the Animal Nutrition Institute, School of Agriculture, Cambridge: I propose to deal mainly with the fertility side of reproduction. The stages of the reproductive process at which fertility can be controlled are mainly confined to three, (1) in the number of eggs which are produced and ripened; (2) in the number of those eggs which get fertilised, and (3) in the number of fertilised eggs which develop properly to birth.

Many factors are concerned. Until about 1920 or thereabouts, little was known of the reason why the follicle producing the egg ripened in the ovary, but about that time we began to realise that it was not something in the ovary itself but something outside the ovary that was responsible. The basic experimental work was done long before but its significance was never appreciated. John Hunter, the noted surgeon, a long time ago had taken a fertile sow which regularly produced ten to the litter, and he took one of the ovaries out, expecting the sow now to produce five, but it produced the same number, ten. He repeated that experiment and the results were confirmed.

In 1920 scientists began to realise that the number of eggs which ripened did not depend on the structure of the ovary or the amount of tissue, but on certain substances circulating in the blood stream, and there was at that time quite an outburst of treating ovaries which were not active by massage, trying to increase the blood supply. Soon after, in 1927, we got it down to chemical substances circulating in the blood, which were produced by the anterior pituitary gland, these substances activating the ovary and enabling it to ripen the follicles and produce eggs.

The first natural factor affecting this process is the age of the animal. Before the age of puberty young animals do not ripen eggs; this is due to changes in the substances circulating in the blood, because when you take an ovary from a young animal and transplant it into an old one, it will ripen eggs and the animal will come into oestrus in a few days. An ovary from an old animal transplanted into a very young one will, however, not function. We see in practice frequently with underfed and backward young gilts, a delay in coming on heat. In the same way with cattle, under conditions of poor nutrition the growth of the body is hindered and the onset of the reproductive period is delayed. That, fundamentally, is due to the lack of these pituitary hormones in the blood stream.

The next factor is the breeding season. In some animals these are very marked, *e.g.*, in sheep the majority of breeds only come on heat from the end of August to March. Then there are the summer breeding animals like ferrets, in which the times are exactly reversed. This has been linked up lately with the length of daylight hours; a case of light acting through nerves on the pituitary gland. It is a widespread phenomenon not only in animals, but in plants: for example, the chrysanthemum flowers in the shortening days of autumn while most flowers bloom when the daylight hours increase in the spring. This factor can be got over in many ways; for instance, injection of anterior pituitary extract during the non-breeding season will cause eggs to ripen, and you can induce many animals to breed by adding to the light ration by the use of artificial light. Lately it has been done in winter breeding goats by the reverse process, *i.e.*, by decreasing the light ration by darkening. We are beginning now to be able to control seasonal variations.

The next factor that affects the ripening of the egg is feeding. It is well known amongst sheep breeders that if you want to get a high percentage of twins you flush your ewes by extra feeding before the tup is put in; while this has been practised over a long period of time it was not realised quite how it works. It will not work in the absence of pituitary hormones and although you can get your sheep into a very thriving condition during midsummer, still they will not come on heat; you must have, besides the food, the internal secretions coming from the pituitary. But these internal secretions will not be effective in the absence of sufficient food. This will also apply to a number of heifers which do not come bulling during the winter season, a condition which is specially prevalent in areas where they are badly fed during the winter. Flushing by feeding helps provided the pituitary secretions are there, but it is useless to have the one without the other.

Then there is the internal control over the number of eggs and the ripening of the egg. This is brought about by the development of the corpus luteum in the ovary after the follicle has ruptured. If the corpus luteum persists it will prevent other eggs being shed while it is active. The follicle instead of rupturing may also go on enlarging and form a cyst; this is due to repression of some of the secretions of the anterior pituitary gland.

Another factor which in some species of animals affects the ripening of the eggs is that of heavy lactation. Perhaps we do not realise the amount of milk in relation to body weight given by the sow, the cat, the rabbit or any other animal which has a large litter; the amount in proportion to the body weight is very great, and in this condition of heavy lactation the ripening of the eggs is prevented. If the number of young suckled is cut down the animal will, however, often breed. This is due, I believe, to the interaction of food with the reproductive hormones.

But these are not the only ways in which the fertility of an animal is controlled. There is many a slip in fertilisation although millions of sperm are introduced in the semen. True, it only requires one sperm to unite with an ovum, but unless the sperms are at exactly the right time and place the chances of fertilisation are very small indeed. In the last few years quite a different outlook on the production of sperm by the male has come about. At one time it was thought that the male was either fertile or infertile; now we know that we can classify males in varied grades of fertility. They are most noticeable in the horse, in which the heat period is long, and you can usually see this grading in the stallion, according to the percentage of foals that he gets. In the bull, where the heat is shorter, the effects are less variable; in the pig it is rather noticeable because of the different sizes of litter that the boar will get. The main factors affecting the production of sperm by the male are not known. If you have a male giving only a few sperms I do not think that there is anything I could recommend with any certainty that would put him right. There is great need here for further investigation. We know quite a number of conditions which will put the sperm production down, but none that will invariably put it up. A few degrees higher temperature, such as obtains in the abdominal testes of the rig, will prevent the production of sperm. It is easy to put a ram's scrotum in a bag of cotton wool and warm it up so that he becomes sterile in about ten days. The function of the scrotum is to lower the temperature of the testes so that reproduction can take place. There are, of course, many other things which prevent formed sperm being ejaculated—adhesions of the epididymis, and so on.

We can diagnose lack of sperm in the male by collecting with the artificial vagina and examining the semen so obtained.

The next point is the time relation between mating and the shedding of the egg. If the sperm are put into the vaginal passage too long before the egg is shed, then the higher temperature of the female tract will destroy the sperm and there will be a very low chance of fertility. It takes somewhere about four hours for the sperm to ascend the tract and as the time beyond this increases, so the vigour of the sperm becomes reduced. This is most important in the horse where you get a long heat period. You may get mating to occur many days before the egg is shed and so lower your chances of fertility. If the sperms are introduced into the female tract after the egg is shed, its chances are also lowered. The sperm fertilises the ovum when the egg is at the top of the Fallopian tube. If the egg is shed and is on its way—say half-way—down the tube before mating occurs, that egg can no longer be fertilised. While it is in the top of the tube it is held by a clot of liquor folliculi; it is in that clot and it is as it comes out that it is fertilised.

The cow sheds its eggs about twelve hours after heat ends. It is possible to inseminate a cow up to some eight hours after she has gone off heat. On the other hand, in the mare the egg is shed about a day before heat ends and mating quite at the end of the heat will give a very low percentage of fertility. As a matter of fact, the pituitary hormones come in very useful here, because if you inject prolan—lutealising hormone—about the time of service you get the egg shed at approximately the right time.

Lastly, concerning the number of ova which develop properly to birth. It is only very occasionally that the ovum splits in two before it begins to develop and in these cases we get identical twins as distinct from those born when two eggs are shed. Certain species

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of animals, such as the armadillo, do it regularly; I believe it also occurs in the marmoset monkey and occasionally in cattle. But in most species the ovum only develops into one embryo. In the early stages of pregnancy, before the ovum can be fixed in the uterus, progestin has to come into play, so that in the early stages progestin, a secretion from the corpus luteum, is the main factor controlling pregnancy. Later, from about mid-pregnancy onwards, this is assisted by a secretion of the same nature from the placenta itself, which supplements the progestin coming from the corpus luteum. This is very important, because I believe that it will now be possible, in animals which regularly abort, to introduce progestin and continue the pregnancy. It has already been done in the case of one valuable mare which aborted regularly. In the mare the corpus luteum does not last the whole length of pregnancy, but it is the placenta which supplies the bulk of the progestin required. This progestin can be over-ridden by the other chemical substances produced by the ovary, *i.e.*, the oestrogens, and if you inject large quantities of these you over-ride the progestin and cause abortion.

The chief things in practice that one is up against during pregnancy are contagious abortion and trichomoniasis. We do not quite know what is the actual cause of abortion arising from these infections, but I suspect it is due to the destruction of these chemical substances in the placenta or to something that prevents their functioning. One often finds in the afterbirth, among pigs especially, a mummified embryo that has died during the course of pregnancy; this is an inherited character. It may be due to lack of some substance in the mother's blood stream, but as yet we do not know what it is. As it is a recessive inherited character, it is liable to occur where inbreeding is practised.

Dr. S. J. Folley, of the National Institute for Research in Dairying: I have been asked to give a brief account particularly of the pituitary gonad-stimulating hormones which are so important nowadays in reproductive work. I think we can say that the concept of the anterior lobe of the pituitary as a regulator of gonad function dates from 1924-25, when we had the classical work of Evans, Aschheim and Zondek, and Smith and Engel, which established the central position that anterior pituitary occupies in reproductive activities.

If you take the anterior pituitary from a laboratory animal such as a rat, the gonads and accessory reproductive organs regress to an infantile condition and one can restore the gonads and accessories by the injection of anterior lobe extract. That type of experiment gave the first clue to the fact that the pituitary secretes gonadotrophic hormones. As more work was done, the idea gradually arose that the observed effects were due to more than one agent and most workers now believe in the existence of two separate gonadotrophic hormones of the anterior pituitary. These are (1) the follicle-stimulating hormone (F.S.H.) and (2) the luteinising hormone (L.H.). The modern tendency in the United States is to speak of the latter as the interstitial cell stimulating hormone (I.C.S.H.).

F.S.H. in the female causes growth and maturation of the Graafian follicles but does not cause ovulation. On the other hand, L.H. is the agent which causes ripe, mature follicles to ovulate and is responsible for the formation of the new structure which appears in the ovary after ovulation—the corpus luteum. In the male, the functions of these two hormones are not so well established, though there are claims that F.S.H. has chiefly the function of stimulating the tubular tissue of the testis, while L.H. is believed to stimulate the interstitial tissue, the tissue which produces androgenic hormone.

It is possible now to put forward a theory of sorts as to the hormonal regulation of the oestrous cycle and you may be interested to have a rough picture of the mechanism. The pituitary produces F.S.H. which causes maturation of the follicles in the ovary; as this occurs oestrogen is produced, which circulates in the blood and in its turn reacts upon the anterior pituitary, inhibiting the further production of F.S.H. but stimulating the production of L.H. The latter is responsible for ovulation and for luteinisation of the ovary. Ultimately the luteal tissue regresses and the cycle of events begins again. As to the action of the corpus luteum hormone (progesterone) upon the anterior lobe, the evidence is less clear, but it seems possible that progesterone may promote the secretion of F.S.H. and inhibit the production of L.H.

It has been known for some time that the pituitary produces a specific lactogenic hormone—the hormone which is usually called prolactin—and recently, evidence has been brought forward that prolactin is responsible for maintaining the function of the corpus luteum. Some American workers, therefore, regard prolactin as a third gonadotrophin possessing luteotrophic properties.

Three other gonadotrophins must be mentioned; these occur in body fluids. The first was discovered by Aschheim and Zondek in 1926 in the urine of pregnant women. This hormone is nowadays usually called chorionic gonadotrophin in this country—elsewhere sometimes P.U. or prolan. The presence of this hormone in the urine forms the basis of the well-known Aschheim-Zondek test for pregnancy in women, in which the presence of the gonadotrophin in the urine is recognised by its stimulating effect on the ovaries of immature mice. It also elicits ovulation in the oestrous rabbit and this effect has been made the basis of the Friedmann modification of the Aschheim-Zondek test. Incidentally, in women who have reached the menopause another gonadotrophin, which apparently is identical with pituitary F.S.H. hormone, is found in recognisable amounts in the urine. The third gonadotrophin found in body fluids is the hormone discovered by Cole and Hart in 1930 in the blood of the pregnant mare. This hormone, known as pregnant mares' serum (P.M.S.) is a predominantly follicle-stimulating hormone which is thought to originate in the chorionic tissue of the placenta and not in the pituitary, as of course is also the case with prolan.

Coming now to a consideration of the experimental and field use of the gonadotrophic hormones, we may begin by considering anterior lobe extracts. Ox anterior lobe extract shows relatively little gonadotrophic potency and its action is largely luteinising. Extracts of sheep or pig anterior lobe are more active but again luteinising hormone predominates. Attempts to use such extracts for stimulating the function of immature or inactive ovaries have not been successful, since the proportion of gonadotrophins present is such that under their influence follicular and luteal phases proceed simultaneously instead of in orderly succession. On the other hand, horse pituitary extracts are very active and follicle-stimulating activity is prominent. Experiments on hypophysectomized rats have shown that horse pituitary extracts contain F.S.H. and L.H. in suitable proportions for causing follicular growth and ovulation in hypophysectomized rats. Of the gonadotrophins extracted from body fluids, P.U. is mainly luteinising in effect but P.M.S. is a strongly follicle-stimulating agent which appears to contain sufficient L.H. to cause ovulation in, at any rate, intact experimental animals.

On the basis of experiments carried out on rats as test animals, it might appear that for stimulating the ovaries of anoestrus heifers, a problem of considerable practical importance at the present time, horse pituitary extract would be the ideal agent. Unfortunately, under present conditions, supplies of this material are not very plentiful, so that one must look elsewhere for a suitable source of gonadotrophic material. Owing to the foresight of the Agricultural Research Council a fairly good supply of P.M.S. is now available for field use. Experiments carried out in this country on the effect of P.M.S. on the ovaries of heifers give some indication of the conditions under which P.M.S. preparations should be used in treating heifers in the field. It has been found in experiments on young heifers undergoing regular oestrous cycles, that if a relatively high dose of P.M.S. is injected in the early- or mid-phase of the oestrous cycle, marked follicle stimulation results, but no ovulation. The ovaries of animals so treated thus contain varying numbers of large follicles resembling cysts. In due course these hypertrophied follicles regress, and the ovary becomes normal without any outside interference, so that in this sense it is probable that these follicles are not true cysts. If the injection is made late in the cycle, however, ovulation occurs approximately at the time at which it would have occurred without the injection, and if the dose is large enough one gets super-ovulation. On the other hand horse pituitary extract has been found to cause ovulation in cyclic heifers when injected at any stage of the cycle, probably because horse pituitary contains more L.H. than does P.M.S. It should be emphasised that these results were obtained on heifers with normal, cyclic ovaries and it is difficult to say how far the conclusions apply to the hypoplastic ovaries of anoestrous animals. However, the results seem to indicate that the maximum dose of P.M.S. for heifers is in the neighbourhood of 2,000 I.U. Further, the injection should never be made in the presence of a functional corpus luteum, otherwise a "cystic" ovary may result and if P.M.S. is injected after enucleating the corpus luteum, which would be equivalent to injecting cyclic heifers in late cycle, the result may probably be superovulation.

I would end by saying that the work we have done and that others have done along this line does indicate that there are tremendous individual variations in the experimental heifers in the response of the ovaries to gonadotrophic stimulation, and there is need for a good deal of further experimental work before the clinician can feel confident in using these very potent agents in the field.

Mr. F. T. Day (Newmarket): The first thing with sterility is to decide whether it is individual or herd sterility. Commencing with male sterility, with stallions or bulls it is a matter of the number of sperms produced and only in a small number of cases does absolute sterility occur. With both stallions and bulls you get animals which are keen to serve, but cannot ejaculate: we recognise the condition but nobody knows the exact cause of it. The other type, in both stallions and bulls, is the animal that shows no interest in the female. Various things have been tried, even gonadotrophic hormones, and sometimes you think you have met with success, but at the moment there have not been enough of those cases treated and recorded to show whether that is just chance or not, because numbers of them

return to normal without any treatment at all. I do think that some work is needed on both types—the one in which the desire is there and the other where the animal takes no notice whatsoever.

I have no doubt Dr. Hammond has talked about the various types of sterility in females of different species. To put them in two main groups, you have the various factors which prevent the fertilisation of the ovum, and the other type where something goes wrong with its implantation. In the mare with a relatively long oestrous period, and ovulation occurring at the end of that period, it is usually failure of fertilisation which results in infertility. Although oestrus in the mare lasts on the average five to seven days in the early spring, many mares remain in oestrus as long as three weeks and some very much longer than this. These mares are a problem; as they waste many services of the stallion and have no chance of becoming pregnant unless one of the services occurs within about five days prior to ovulation. You can, by injecting pregnant women's urine extract, induce ovulation, and if you mate them the day before you inject you get about 50 per cent. fertility results; ovulation occurs in approximately 80 per cent. That is a means we have of dealing with cases of the first type. When something goes wrong with implantation in mares the commonest cases are seen in mares which either through bad conformation of the vulva or because of a torn vulva, suck air into the vagina, resulting in ballooning of the vagina, and often a catarrhal inflammatory condition of the whole of the genital tract. These animals come in oestrus regularly, but they very rarely breed.

If it is a mare that has failed to come on after foaling, more often than not they are ovulating regularly, but not showing oestrus. You can spot these mares by introducing a speculum into the vagina every third day and waiting until you get complete relaxation of the folds of the cervix; then if you put a twitch on them you have no difficulty in covering them. There are other mares that do not come into service and do not appear to be ovulating, but have a number of follicles in their ovaries. I hesitate to say that nothing will definitely "do the trick" on these mares; I think the mere fact of manipulating these mares is often enough to "press the trigger," but in those injected I do not think there is sufficient evidence to show that we really can succeed with them.

The other trouble is cystic ovaries; it may be a foaling or a maiden mare, or a mare that is barren. During the anoestrous period the follicles may go down and the animal behave quite normally the following season. Should there be one or two large cysts, if you puncture them through the vagina a number of the mares thus affected will come into season afterwards. Some of them after coming into season will push up cysts again. The cysts should be ruptured and when they do come into oestrus it is advisable to inject them with pregnancy urine extract to make sure that you do get ovulation. Cysts in mares—and in every animal for that matter—are not permanent things which are there for ever and a day. You have got to think of cystic ovaries just as an expression of an abnormal pituitary gland. A lot of them will eventually cure themselves and in many cases it is only a temporary thing.

Occasionally you get mares with a thickened uterus and a certain amount of creamy discharge, and everything else apparently normal. This condition is seen only in old mares, and once it starts seems to exist for a number of years and eventually the animals so affected have been destroyed. I only mention it as a matter of interest. As a "shot in the dark" two mares of that type were implanted with stilboestrol this year and the implantations were left in for nearly six weeks. At the end of that time the uterus had returned to the size and consistency of the maiden uterus, and both of these mares got in foal at the first subsequent oestrus. That is worth bearing in mind, because previous experience of irrigating them, etc., gave no results.

I think Dr. Folley made reference to the injection of pregnant mare's serum in cattle. In 25 per cent. of cases of anoestrus it gives you oestrus with ovulation, and if you serve them you have just as good a chance of getting them to breed by that induced heat as by natural mating. The other type is when you get a persistent corpus luteum. Removal of the corpus luteum is our present method of dealing with these cases and it is fairly successful. Stilboestrol was tried in that condition but it did not prove very satisfactory. You get oestrus from the direct effect of the stilboestrol, but a long period elapses between the time of treatment and the time when the cow gets in calf.

In practice the majority of cases we are called upon to treat are animals which we diagnose as suffering from metritis, as determined by examination of the cervix per rectum. That type of metritis, with no visible discharge from the vulva, is very common. It is not a condition transmitted from cow to cow or transmitted by the bull. If the uterus is fairly well contracted up, ordinary iodine irrigations give you good results in the field, but the thing that always puzzles me is just why we should get this very high percentage of non-specific metritis. It is common in the best-managed herds; in fact, it is common in all herds that you visit. I think a lot of it may be due to what is really bad management at parturition, although on the surface it may appear to be good management. By that I mean that in recent years people have been accustomed to "steam up" their animals before calving and to go on feeding them to maintain lactation. I would like to compare the uterus just after calving with an ordinary open wound. If you are getting an animal up for show and it sustains a wound anywhere on the body you get tremendous oedema and altogether a far worse and more septic condition than if the animal had been on an ordinary ration. In parturition, with the uterus, as I have said, simulating an open wound, one can visualise terrific oedema in the walls of the uterus, making secondary infection with organisms that ordinarily would not matter quite a serious factor. I think if people would only starve animals two or three days prior to calving and perhaps a week afterwards, they would not lose any appreciable amount of milk and the uterus would be given a chance to contract up in the normal way. I know that Mr. Gould is speaking later, and I understand he is going to deal with venereal diseases of cattle, and any comments I make on that I will make in the discussion on that matter. There are two distinct types of behaviour with cystic ovaries in cattle; one is anoestrus with cysts and the other nymphomaniac symptoms with cysts. The former responds very well to treatment by repeated rupture of the cysts with the formation of a normal corpus luteum. With the nymphomaniac type you can rupture the cysts as often as you like without result.

I do not think we need discuss artificial insemination in conjunction with sterility in cattle, but in mares it does play quite an important part. With mares, as a rule, you do not get relaxation of the cervix until about the last 72 or 48 hours before ovulation. Sperm from a good stallion can give you fertility at any rate for six and probably for seven days, but if you mate early, about four or five days before ovulation, the chance of any quantity of sperm getting into the uterus is small and insemination of these cases by introducing a reasonable volume of the sperm does put up your fertility results.

Mr. G. N. Gould, Jnr. (Southampton): My contribution to the discussion will be limited to the dairy cow, the breeding problems of which have interested me for many years.

Herd management is the most vital factor affecting reproduction. Where breeding efficiency is to be maintained, a high degree of supervision is demanded and adequate records must be kept.

The problem of the anoestral heifer has been fully dealt with. My practical experience to date with P.M.S. has been somewhat disappointing, but since it is definitely better than that claimed by the Ministry's sterility officers from information given to Mr. Day I have no cause to be unduly pessimistic.

Dr. Hammond's remarks regarding the nutritional aspects of this problem coincide with my experience in the field.

Management, which aims at maintaining heifers in a sufficiently high condition to enable them to show and maintain oestrus in the winter months is desirable. The poor condition of the heifer and the absence of oestrus is a vicious cycle; an improvement in condition by the provision of adequate foodstuffs, in the absence of oestrus, is, in my experience, not so easily or so rapidly effected as improvement in the unthrifty heifer which is coming into normal oestrus. A very marked improvement in bodily condition has to be brought about before oestrus is shown in true anoestral cases, and this often takes months in the absence of other treatment.

The use of oestrogens in anoestrus has also been dealt with and their limitations must be stressed. They are of far greater value in the treatment of some forms of endometritis, particularly specific and non-specific pyometra, and in retention of the foetal membranes.

Authoritative information on the care and handling of the parturient animal should be imparted to dairy farmers by the profession—particularly in respect to the handling of the cow at parturition. How often is aid applied when not required, particularly too early, and injury to the cervix (a major cause of permanent sterility) or vagina inflicted by enforced delivery prior to complete preparation being effected by the natural processes. How often is interference delayed until the foetus is dead, rigid and in some cases emphysematous by leaving things to nature. No definite time for action can be laid down, but skilled examination at the appropriate time can and will indicate the possibilities and probabilities of successful delivery, and where mal-position is present enable it to be rectified at the most opportune moment. I have from time to time found ante-natal examination of considerable value in determining whether or not difficulty was likely to arise at parturition and thus been prepared for it. The tendency of herdsmen and others to aid delivery when parturition is proceeding normally is to be deplored. How often does one find in such cases that the membranes are retained.

The problem of retained foetal membranes is intimately conneeted with reproduction. Their removal is often looked upon as part of what used to be called rough country practice. In my opinion the removal of the foetal membranes should be considered a highly skilled operation fraught with danger to the life of the dam and with definite danger to future reproduction. I venture to suggest that

we would all welcome an enquiry on the lines of the survey committee's reports on recommended procedure in dealing with this very common condition. In my experience, again, no definite time for action can be laid down—each case must be dealt with on its own merits. Attempts at manual removal are often ill advised.

The advice given in the original survey report to withhold from service all cows and heifers showing abnormal discharge or abnormality of oestrus pending treatment and recovery is the cardinal principle of good breeding management.

The Bull in most herds is the most neglected animal on the farm, and yet he is the most important factor in herd improvement and the major factor in herd fertility. We could usefully draw up recommendations for the guidance of the dairy farmer regarding the management and use of the bull. Points that occur to me are under-use, which is all too prevalent in small herds, the over-use of the young bull, the maintenance of good active breeding conditions, the optimum time for service; the value of maintaining a bull for the use of maiden heifers only (in large herds where this is possible) as an item of disease control; the hygienic management of the bull (particularly the communal bull) and the possibilities of artificial insemination.

Good herd management must, of necessity, involve disease control.

The incidence of tuberculous lesions of the genital organs appears to be much more marked in some parts of the country than in others.

The control of contagious abortion by vaccination has, in my experience, brought about a very marked reduction in the incidence of infertility in infected herds. It has to be appreciated that it is not only the actual aborting cow or heifer which is so frequently rendered infertile but the infected animal which does not abort.

The significance of the reacting bull is, to my mind, an unsettled problem. Evidence has been produced purporting to prove that it plays little or no part in the spread of this disease at coitus.

I have met instances of widespread abortion in unvaccinated herds, always involving both cows and heifers, in which the bulls utilised have subsequently been shown to react to the blood test and to be voiding *Brucella* in the semen. In these instances early abortion at three to five months has been the rule. With no alteration in the arrangements for dealing with the disease other than the elimination of the reacting bulls, a marked reduction in incidence has followed, particularly in the heifers served by non-reacting bulls. This may be coincidental, but I have met this circumstance frequently enough to be impressed by its possibilities. There can be no doubt that the retention of a reacting bull is bad policy, and contrary to good herd management—if for no other reason than the gradually deteriorating fertility of the infected bull.

Pyogenes Infection.—A venereal disease associated with early abortion or with "whites" after apparently normal calving in infected herds appears to be on the increase. This disease, if neglected is more disastrous in its effect on breeding capacity in infected herds than either abortion or trichomoniasis. I frequently meet cases of what appear to be sporadic "whites" due to pyogenes infection. "Whites," whether specific or non-specific, is undoubtedly a major cause of permanent sterility. Treatment can be effectively applied in the early stages.

Trichomoniasis.—A venereal disease of which much has been written in the last few years, and the importance of which has only been slowly accepted, similarly appears to be on the increase. Whether this increase is apparent or real, I am unable to say. It is possible that the disease is now more commonly diagnosed than in the past and this may be responsible for a false impression. The difficulty of confirming diagnosis is well recognised, and this, allied to the insidious nature of the disease, tends to allow it to become widespread in a herd before active steps are taken to control it. The optimum time for demonstrating Trichomonads in the discharges is a few days prior to accepted oestrus (three to four days). The organisms are far more easily demonstrated in the discharges accompanying or following abortion. The work of Kerr, of Stormont, has shown considerable light on this disease. The development, in conjunction with Dr. Muriel Robertson, of an agglutination test as an aid to diagnosis which gives every indication of reliability is a great step forward. The possible introduction of an intradermal test—which is at present being subjected to careful trial in the field—will, if successful, be a further means of making confirmation of diagnosis, particularly in the bull, by demonstration of the organism in discharges, much less onerous in the future. The effect of this disease on milk production and reproduction in the individual herd is, in my experience, much more disastrous than contagious abortion. If neglected it means dry cows and no calves, the abortions which occur being unaccompanied by any tendency to mammary development, such as is seen in *Brucella* infection.

The treatment of the condition is remarkably efficient, but demands patience and strict adherence to instructions on the part of the owner and hard work and skill on the part of the veterinary surgeon. In my experience it is not difficult to obtain 80 to 90 per cent. recoveries to full breeding capacity in heavily infected herds.

The problem of control is ever present, particularly in the case of the communal bull. But, unlike most veterinary surgeons who have dealt with this disease, I have found it necessary to utilise—after treatment—known infected bulls on recovered stock in pedigree herds owing to their high commercial value, and have carried out this policy with success. The use of pessary dressings in treatment carried high up the prepuce and permitting the bull to draw when the pessary has melted, presents the easiest and least objected to method of disinfection. In my experience the infertility in the herd is due to the manifestation of the disease in the cows and heifers. The fertility of the bull may be affected where clinical symptoms are manifest, and the "lazy" service of infected bulls has been described by Kerr.

It is impossible to be 100 per cent. certain that a treated cow no longer harbours Trichomonads, and the introduction of a new bull must always be associated with risk of infection to the bull if used on treated stock.

The use of pessary dressings as a recommended feature of bull hygiene adopted at regular intervals, particularly in the case of communal bulls, presents a means of reducing the risk and limiting the spread of infection in this and other venereal diseases.

More recent work of Kerr has shown that the clinical observation of tenseness or so-called oedemic hyperplasia of the infected uterus is due to a state of allergy, due to sensitisation against the trichomonad antigen. He agrees with the clinical observation which I recorded in 1936 that the condition is a clinical prelude to all abortions in this disease. An interesting factor is that Abelein reports cases of repeated tympany associated with trichomonas infection, not recognising that the symptoms were due to a specific allergy due to trichomonas antigen absorption.

An increased incidence of allergic indigestion (unassociated with trichomonas infection) in cows has been noticeable in my part of the country—apparently associated with sensitisation to proteins contained in the foodstuffs, grasses, etc.

We have to appreciate that we are the witnesses of a revolution in agricultural methods in this country. The ploughing-up policy, leys, reseeding of pastures, the use of home-grown in place of imported foodstuffs, the improvement of what permanent pasture is left, by more efficient management, increased stocking and herd grazing, and the application of fertilisers with a view to effecting improvement in the type of pasturage and the yield per acre has led to radical changes in the diet of the dairy cow. Selective grazing is no longer possible. The bulk of hay fed is vastly different from that utilised before the war, consisting mainly of seeds hay and clover. In the next two years we shall have the stock produced on this system as the adult stock of the dairy herd responsible for the maintenance of the milk supply and the calf crop.

The effect of over-liming of certain types of grass land, and consequent fixation of manganese is well known to you. Is it possible that further problems associated with the essential requirements of the dairy cow may, on occasion, influence the reproductive processes in the future?

General Discussion

Mr. H. W. Steele-Bodger (Tamworth) appreciated the privilege of the invitation extended to him to be present that afternoon.

With regard to the corpus luteum and its behaviour, he had on a number of occasions deliberately expressed a corpus luteum from ovaries of cows at intervals of between 14 and 21 days after service, and the animals had calved to term with no history of subsequent services. He wondered whether it were not possible that the short interruption in the production of progesterone—followed again by the formation of a corpus luteum—might be insufficient to cause the expulsion of the embryo, which normally occurred when the corpus luteum was expressed in early pregnancy.

Mr. Day's statement that pregnant mare's serum gave 25 per cent. success was at variance with his (Mr. Day's) previous evidence. He personally had had much better results. The biggest objection to the use of P.M.S. was the disappointingly high percentage of 'silent heats' which necessitated a second visit about the tenth or twelfth day following injection to determine the presence or absence of a corpus luteum. In the greater proportion of these 'silent heat' cases expression of the corpus luteum would produce visible oestrus, and he was surprised to hear an expression of opinion that the number of ovulations which followed P.M.S. was dependent upon whether or not there was a corpus luteum present or upon the stage of oestral cycle. When there had been definite evidence that there had been true anoestrus in heifers they had also had definite evidence of multiple ripe follicles. It was not unusual after injecting 1,500 units of P.M.S. intravenously, to find ten days later a single corpus luteum in one ovary and three or four in the other. But in these cases they still had 'silent heats.' In his experience there was no relationship between the number of ovulations and the intensity of oestrus.

If one had multiple ovulation and multiple corpora lutea after service would one require to express all those corpora lutea in order to get return of oestrus, or, supposing one thought that in view of having multiple corpora lutea one had multiple foetuses, would expression of a proportion of corpora lutea terminate pregnancy or affect the number of mature foetuses?

Mr. Steele-Bodger was very interested by the possibility of progesterone injection as a means of maintaining pregnancy, and asked what product was recommended; the price of this was a very material factor as he was of the opinion that much could be done in cases of irregular oestrous cycle if a reliable luteinising hormone was marketed at an economic figure. He understood that Bayer's prolan contained luteinising as well as follicle-stimulating hormone.

He had seen at Cambridge several rams which had been implanted with stilboestrol; each had developed an enormous scrotal hernia but when the implant was removed, reduction gradually took place. Assuming that the hernia was caused by relaxation of the inguinal ring and pelvic ligaments as a result of the absorption of oestrin,

Mr. Steele-Bodger asked whether it was arguable that progesterone would have the opposite effect, and what would be the effect of progesterone implants on congenital hernia in the domestic animal.

He was interested in Mr. Day's remarks on the use of stilboestrol in the treatment of metritis and instanced several cases of chronic cervicitis and endometritis which had cleared up following an implant of stilboestrol and the animals had subsequently bred.

With regard to cystic ovaries; where the condition was confined to one ovary and expression of the cysts had yielded no result, he had tried follicle-stimulating hormones in an endeavour to get the other ovary, which often remained inactive, to function, but without success. In two such cases where the condition was unilateral, he had obtained ovulation on the left side, in one case naturally, in the second following P.M.S., after removing a cystic right ovary.

Mr. Steele-Bodger did not agree with Mr. Day's statement that protrusion of the annular folds of the cervix, as diagnosed per rectum, was always indicative of endometritis. In a high percentage of cases, when examined with a vaginal speculum, these protrusions were found to be old lesions which had completely healed; very frequently the animal was found to be pregnant. He considered that an examination with the aid of the vaginal speculum to be the only method by which it could be determined whether or not an active cervicitis existed.

Regarding physiological infertility, Mr. Steele-Bodger said that in his experience, the most common cause, since the war, had been the great increase of parasitism in young stock. He agreed that malnutrition was important, but he believed the profession did not recognise sufficiently the influence of parasitism upon the health of young cattle, and particularly its importance as a cause of anoestrus.

Mr. Leslie Pugh: He thought they would agree with him that they had been most fortunate in having as their openers for the discussion so many well recognised authorities on the subject. The terms of reference of the discussion were so wide—since apparently reproduction was the main function of animal life—that they had almost been given too much food for thought and discussion.

Dr. Hammond had mentioned calcium and phosphorus in its association with pregnancy and lactation. He (Mr. Pugh) thought in creating these milk yield records in cows we were going very near the danger line in calcium and phosphorus depletion. Marshall coined the term "physiological osteomalacia" for this state existing at the termination of pregnancy. If, then, one superimposed another heavy lactation period the depletion became so severe at times that the cow would cease to come into oestrum for several months. It looked as though nature—which after all was no fool in these matters—did make an effort to hold up the rush by this means.

Messrs. Day and Gould had referred to the importance of herd management with special reference to the parturient animal. With this conclusion they must all heartily agree. Mr. Pugh said he considered it a mistake to wean a calf immediately after birth. A calf when it suckled its dam brought about a rhythmical contraction of the uterus which, when repeated at frequent intervals, accelerated the involution of the uterus and he considered that a bi-daily milking of the cow's udder by hand or machine was a poor substitute for the day and night physiological massage of the uterus promoted by the suckling of the calf. It must be remembered that if involution could be accelerated the risk of metritis was greatly lessened. Moreover, should a mild degree of metritis exist already and the physiological stimulus to involution be withdrawn, there was every chance for the infection to set up a chronic metritis with all its sequelae.

He would have liked Dr. Hammond to have referred to some of the principles affecting reproduction coming under the heading of heredity, such as troubles arising as a result of artificial selection on the part of breeders. For example, in Pekingese if one crossed a champion dog and a champion bitch, the marked achondroplastic features in these two parents would appear to lead to the production of a large number of non-viable cleft palate pups. But if one crossed the same dog with a less classical bitch, one with a longer body and not too flat a face, then one seldom saw these abnormalities. The same principle applied to the Dexter breed of cattle.

He thought that the discussion would prove a useful corrective to the present-day tendency to standardise the treatment of sterility in cattle. When one was very busy there undoubtedly was a great temptation to do this, but if real progress was to be maintained in this subject then it was an attitude of mind to be fought down.

Mr. A. Cornish-Bowden regretted that the dog and the cat had not been discussed that afternoon. He had had some hopes of hearing something with regard to the troubles that dog breeders were up against, and one thing about which he particularly wanted to gather some information was the time of ovulation in the bitch. The bitch was one of the animals that had a prolonged oestrus and they were all aware that the life of the ovum was extremely short. They were also aware that a bitch could be mated successfully and prove in whelp after a very long period of days—far longer than any ovum had yet been known to live—but no one, so far as he could make out, knew the period of ovulation in the bitch. He had known breeders who regularly had their bitches mated on the third and fourth day after coming in season, and they claimed that they got the best results by that means. Other people would wait till the 16th or 18th day and they equally claimed the best results, but no ovum would live a period of ten days and remain capable of fertilisation. He did not know if Dr. Hammond had any remarks to make on the subject which would possibly be helpful to them.

Dr. Amoroso: Dr. Hammond in his discussion had rightly stressed the importance of the female factors which control fertility, but it was disappointing to find that little or no attention had been directed to such questions as the viability of the spermatozoa, their fertilising powers and the influence they exerted upon the egg prior to fertilisation. Moreover, while a good deal of the discussion had been concerned with the induction of ovulation, the nutritional requirements of the egg had not been commented upon.

The fate of the ovum depended at all times upon its nutrition and affecting this at one time or another were the secretions of the tubes and uterus, and the sensitisation of the endometrium, and at all times the perfection of its own auxiliary devices for attachment, and the adequacy of the blood supply to the uterus and its contents. It was thus evident that the possibilities for affecting the viability of the egg were manifold.

He (the speaker) could not agree with what Dr. Hammond had said about the leisurely transit of the ova through the upper part of the tube. Indeed, it was more rapid here than elsewhere in the tube and it was very probable that the initially rapid descent of the eggs through the upper reaches of the oviduct served the important function of moving the ova quickly into an environment where they could be maintained viable through the nutritive action of the secretions of the tubal epithelium which were maintained by the influence of the corpus luteum. The interval which elapsed between the entry of the ovum into the tube and the time of its attachment to the maternal organism was a very critical period in the development of the animal; and until they knew something more about its nutritional requirements and about the physiological mechanisms involved in the retention of the free uterine blastocyst, they were not entitled to exclude them from their discussions on fertility and related problems.

Dr. E. G. White: Dr. Hammond had rather suggested that of all the million of sperms introduced into the female genital tract only one reached the right spot in the Fallopian tube and fertilised the ovum. Was it not more probable that a very large number of sperms in fact reached the ovum and by production of hyaluronidase and perhaps in other ways prepared the way for penetration by the single lucky sperm?

When Mr. Day referred to cystic ovaries in the mare how did he distinguish between a condition in which one or more follicles had—perhaps only for the time being—failed to complete their development and cystic ovaries in which the cysts appeared to be permanent, symptoms of nymphomania occurred, and removal of the ovaries was frequently the treatment recommended? He gathered that Mr. Day was implying that so-called "cysts" in the ovary in mares would often spontaneously disappear and that the term "cystic ovary" was sometimes used incorrectly.

Mr. Steele-Bodger: He would like one of the speakers to tell them, if they could, at what stage the ovum left the Fallopian tube. That was a very practical question and a very important one. He believed it was a rational treatment, in many cases of hyperplasia of the uterus, to irrigate the uterus after service. In some herds they made a practice of irrigating cows 24 hours after service, and a remarkably high degree of fertility followed that treatment. Frequently, irrigation was carried out five days after service and he had records where it had been done after 14 days without any ill effect.

He must express profound disappointment at the results of laboratory examination of uterine and vaginal secretions. It was very disappointing when one sent repeated samples to a laboratory in cases where there was gross evidence of pathological conditions both of the uterus and the vagina and the result came back "no evidence of organisms of pathological significance." That was remarkable, and also remarkable were the powers of resistance of the foetus sometimes to gross infection.

Dr. Amoroso: In reply to Mr. Cornish-Bowden's question regarding the time of ovulation in the bitch, it was generally agreed that this was spontaneous and in the speaker's experience occurred most frequently 24 to 48 hours after the time of first acceptance. In the cat, however, it only occurred after copulation or some comparable stimulus, usually 24 to 30 hours thereafter. Concerning the time of arrival of the eggs in the uterus, that is, the length of the tubal sojourn, this varied a good deal in the different animals. In the goat and sheep it took about four days; in the cat five or six days; and in the bitch it was seven or eight days. Tubal transit was more rapid in the pig than in any other of the domestic mammals and took about 48 hours. It was independent of the length of gestation, the size of the egg and the length of the tube, though it might in some way be correlated with the time of differentiation of the auxiliary implanting devices.

Mr. Tom Hare (the President): He felt that pathology had been somewhat neglected in the discussion. The influence of neoplasia and teratomata of the gonads were of interest to practitioners. Also he would like to have heard mention of gynandromorphism, particularly in birds.

Mr. Steele-Bodger had rightly emphasised the influence of parasitism. Mention had been made about the influence of light. Members of the parrot tribes, which had been bred in this country for a number of generations, followed the breeding cycle of the wild birds of Australia. Here they mated at the darkest period of the year, about November.

The medical profession had the term "gynaecology" for disease of the female genitalia. The veterinary profession required a term to cover the subject of this afternoon's discussion. Mr. Pool and he were talking about such a term and they would suggest "genetopathy," which meant disease affecting the reproductive functions. They would commend the term to the attention of the profession.

He would now call upon the openers, in reverse order, to reply to the discussion.

The Replies

Mr. G. N. Gould: He wished to emphasise that the treatment of the bull in trichomoniasis was a step dictated by economic factors in particular circumstances and was in no way a guaranteed cure. Where it could be avoided and a new bull introduced for treated stock that was the ideal. He did not believe it was possible to be certain of complete cure of trichomonas infection in the bull even in early cases. Treatment necessitated six to eight weeks' rest from service, and pessary dressings—applied regularly three times a week during the rest period and then after each service, or if not used, at least once a week as long as one kept the bull in the herd. *Use was definitely restricted to treated females.*

Mr. F. Day: Mr. Steele-Bodger had called him to order in the matter of the percentage effectiveness of pregnant mare's serum in anoestrus in heifers. He had purposely given that figure because this year, those people designated as sterility officers were asked to inject all the anoestrus heifers they could find with doses of P.M.S., they picked out localities all over the country and the grouped results did come out at around 25 per cent. oestrus plus ovulation, and of course a very much bigger percentage of ovulation without oestrus. In the Eastern Counties results for several years had been considerably better than that.

Dr. White had asked what were cysts in mares and why was ovariotomy carried out. Ovariotomy was usually carried out because of the temperament of the mare: one got a spiteful type of mare; she could not be described as a nymphomaniac, but took a dislike to other horses working with her. Such mares were constantly raising the tail and erecting the clitoris and the result was a spiteful type of behaviour such as any mare would show when "not in oestrus" and taken up to the trying board for a stallion. Of such mares that had been subjected to ovariotomy he could only say that he was not at all sure that any improvement resulted.

"Cystic ovaries" was not a hard-and-fast term; it was just a clinical condition found at the time of examination. One found that the regular cycle was not occurring but follicles were just maturing and regressing. If by injecting luteinising hormone you induced ovulation and got a corpus luteum formed, one had a good chance of restoring the cycle.

Reference had been made by Mr. Steele-Bodger to the diagnosis of metritis by examination of the cervix per rectum. In spite of what Mr. Steele-Bodger had said he still thought it was the best criterion of all for the diagnosis of metritis. In a few cases, he admitted, one got a chronic "cauliflower" type of cervix in which the protrusion of the folds was so great that they never did get back to normal. A fairly large cervix after pregnancy was quite a normal thing. He thought the extra amount of information gained by the use of the speculum together with rectal palpation, was not worth while when dealing with any numbers, for the additional amount of information one got out of it was negligible, though the speculum might be used if one was in doubt about any particular animal.

Dr. Folley: He was interested in Dr. Hammond's remarks about anoestrus in animals giving heavy milk yields. Possibly some recent experimental work might throw some light there, because it might be that animals producing a lot of milk were also producing a lot of prolactin and it had been shown that prolactin had an anti-gonad effect.

As he had said in his remarks, although the two pituitary gonadotrophins had been shown experimentally to produce effects in the male, up to now they had not proved of much practical use, and he thought that was a field for further research.

In regard to Mr. Steele-Bodger's observations about pregnant mare's serum, it should be noted that what he (Dr. Folley) had said referred only to cyclic heifers and not to heifers with hypoplastic ovaries. In heifers they had not been able to elicit ovulation with P.M.S. unless given a few days before expected oestrus.

He thought progesterone was a hormone that was proving useful in clinical work in the human, but the difficulty was that it was expensive; its price was certainly prohibitive for veterinary use. Here was a field in which the Agricultural Research Council could lend its support, because if the organic chemist could give us an analogue of stilboestrol possessing progestational activity but no oestrogenic activity, such a substance would undoubtedly have a wide use in animal husbandry.

In reply to Mr. Pugh, he was not a pathologist and he spoke cautiously in the presence of professional pathologists, but he would throw out the suggestion that

the true multiple cysts of nymphomania were not normal follicles and that one could ovulate only normal follicles with luteinising hormone.

Dr. John Hammond: Mr. Day had mentioned the importance of the management and feeding of the down-calving cow. He could certainly endorse that view, because under conditions of continuous heavy feeding both before and after calving he knew many cow-keepers who had run into no end of trouble, not only with the uterus but with the udder also.

Mr. Gould had made reference to trichomoniasis, but there was one possible solution of the *Trichomonas* trouble which had not been mentioned—this was artificial insemination. It was the contact with the infected bull that spread the disease around, especially with the communal bull. He thought that artificial insemination was a promising method for future trial as a means of control.

Mr. Steele-Bodger had raised a large number of points, most of which he could not answer because further experimental work was required. Certainly squeezing out the corpus luteum would cause abortion in pregnant cows in a very large number of cases, but there were one or two cases within his experience in which that did not happen, and it was a matter of finding the right explanation. If he were to venture upon one he would say that the new follicle ripened with such speed, forming another corpus luteum, that the results on the uterus were not marked and so an embryo was not turned out. He admitted that much more work should be done on those lines. Mr. Steele-Bodger also asked if, in the event of several corpora lutea being present, it was necessary to remove them all before the animal would come on heat. Yes, that was so; all trace of corpus luteum tissue had to be removed. As to whether one corpus luteum only was sufficient to maintain a multiple pregnancy, however, he was not quite so certain, because of the results of some experiments made long ago by Fraenkel on the rabbit. When ten embryos were present and he reduced the corpora lutea to one or two, abortion followed in the late stage of pregnancy.

As Dr. Folley had said, the use of progestin in practice was prohibitive by reason of its price. He might overcome that difficulty by getting super-ovulation during pregnancy, first of all by injecting follicular hormone and then injecting lutealising hormone. Mr. Steele-Bodger also mentioned the case of the ram that had developed scrotal hernia after implantation with stilboestrol. Stilboestrol loosened up the ligaments in that area very much as it did in the female and one result of that was that when one put stilboestrol tablets into a heifer it "jumped" the others, and with the ligaments of the pelvis loosened, fractures sometimes occurred. Whether in the ram scrotal hernia could be overcome by progestin was not certain, but it was certain that the loosened ligaments due to continuous bulling in the female could be overcome by progestin; he should also imagine that progestin, if implanted into animals secreting too much oestrin would reduce the effect of that hormone.

Mr. Pugh had raised the question of heredity. He did not go into that deeply because time was limited. He had, however, an inbred strain of rabbits which had an inherited tendency to cyst formation and he should not wonder if the same thing applied in the bovine. There was also the inherited character of the "bull-dog" calf, for example. He felt certain, with Mr. Pugh, that there were a number of characters in cattle, giving rise to defects of the embryo, which could be traced to genetic causes and that appropriate methods would avoid them.

The time of ovulation in the bitch had been a matter of much dispute. In the U.S.A. Evans said that the bitch varied a great deal in the exact time at which ovulation occurred in relation to heat; whereas Whitney said that there was a fairly definite time at which the bitch ovulates. Two matings at an interval of two days was suggested by Whitney, who advised mating at about ten days after the beginning of the swelling and then again at about twelve days after.

Dr. Amoroso had raised the matter of the attachment of the placenta. This speaker had referred to Day's work and Day's cases of sterility in mares sucking in air were due probably to defect in placental attachment.

In most cases the sperm would remain fertile in the scrotum about 40 days. When it got into the female tract, in a higher temperature, the period of its viability varied in different species and in relation to the absence or type of scrotum the inseminating animal had. The turkey had no scrotum and the life of the sperm was very long therefore in the female tract. The sperm of the stallion would live longer in the mare—up to six days or so—than the sperm of the bull because of the differences in type of scrotum in the two species. The viability of bull sperm in the female passages was about 30 hours. In all species that they had investigated so far, when one came to test the time relation between ovulation and fertilisation it was very short. In farm animals, especially, they should know much more about this before definite times of mating during heat could be laid down. He quite agreed that in species like the rabbit, where there was a lot of debris round the shed ova, the first sperm to get there would tend to dissolve the debris rather than fertilise the ova, but the number introduced in order to fertilise the ovum while it might vary with the species would still be very large.

In reply to the President's question as to the time taken to change the breeding cycle after transference across the Equator, some species changed almost at once; other species would hang on to the former breeding seasons tenaciously. Some species would breed all the year round, no matter what the light ration might be. Birds and mammals native to the Equator would breed at nearly all times of the year, whereas those which had their origin near the Poles, say, in Iceland, had a very short breeding season. Breeding seasons had been developed in relation to daylight hours so that the young were born at the best time of year for their survival.

It seemed to him that the whole of that discussion had shown the need for further research in many phases of the subject. He hoped it would stimulate those people who were doing research to find out something more about these things.

AUSTRALIAN VETERINARY ASSOCIATION'S DISEASE SURVEY

Particularly in view of the similar war-time contribution to the nutritional well-being of the community entered upon by the N.V.M.A. at the outbreak of hostilities, the following extract from the Annual (1942) Report of the Hon. Secretary of the Australian Veterinary Association, which has just reached us, is of interest:—

National War-time Service of Veterinarians

"During the year Council felt that some improvement might be effected in the better utilisation of the profession in the national interest, and, with the object of reporting upon existing conditions, set up a number of sub-committees to report to Council upon the following: (*a*) Control of Diseases and Parasites of Livestock, (*b*) Brucellosis and Strain 19 Vaccination, (*c*) Sterility, (*d*) Tuberculosis, (*e*) Calf Mortality, (*f*) Poultry, (*g*) Nutrition, (*h*) Artificial Insemination (*i*) Progeny Testing, (*j*) Man Power, (*k*) Pigs. The reports from the committees on these subjects have been received and at the close of the year Council was considering further action to implement the recommendations made by the committees."

THE VETERINARY RECORD
February 5th, 1944

BOVINE INFERTILITY

We publish in our issue of this week a report of the discussion on "Principles Affecting the Reproductive Functions" recently held by the Central Veterinary Society. Several well-known experts contributed to the discussion and it was made clear by their remarks that there is still much to be learned about the physiology of reproduction, particularly with regard to the influence of certain hormones.

That temporary infertility is widespread in dairy cattle has only become strikingly and increasingly recognised by the veterinary profession for about half a century. Treatment of barren cows by ovarian massage and uterine irrigation was adopted by several veterinary surgeons nearly 20 years ago, especially following the demonstration by Nielsen at the Association's annual congress in Aberdeen. Further stimulus has been given to the subject by the findings of more recent workers. There was, however, no organised attempt to control or treat bovine infertility on a large scale until the present war. In fairness to the profession, it should be appreciated that the delay in the more general application of individual treatment was due, amongst other things, to agricultural economic policy. Many good but infertile breeding animals were disposed of because there was for a time very little difference in price between a cow kept for milking and one fattened for beef.

The profession's part in the present attempt to tackle this problem on a large scale needs no reiteration here; the practitioners' efforts have extended far beyond the panel herds, and a sum total of benefit much greater than official figures can show, may result.

Every case of infertility presents its own particular problem. Increase in our knowledge of the abnormalities of the process of reproduction has shown that the treatment of infertility cannot be standardised, several modes of intervention at first sight widely different in kind being credited with beneficial effects in the hands of different operators. That a solution of the more urgent of the problems of infertility will eventually be found is likely. Some of the factors adversely affecting reproductive functions may be those which the profession must eliminate if its present drive for the promotion of animal health is to continue. Thus it has been suggested that the control of bovine contagious abortion alone might materially reduce infertility. Similarly, with the veterinarian assisting to advise in other matters relating to animal husbandry, including genetics, dietetics, and herd management, infertility due to physiological derangement might be considerably reduced.

It remains to be seen what will be the effect of the continued production of heavy milking cows, autumn-calving, increased use of artificial fertilisers on grassland, and various other factors associated with modern farming conditions. It is certain that the closer and more sympathetic co-operation which is now developing between the farmer and the veterinary surgeon adviser will eventually solve many of the problems with which they may be faced.

Weekly Wisdom

"*The study of biology trains the mind in accurate methods of observation and correct methods of reasoning, and gives to a man clearer points of view, and an attitude of mind more serviceable in the working-day world than that given by other sciences, or even by the humanities.*"
—William Osler, "Aequanimitos, with other Addresses."

CLINICAL COMMUNICATION

Abortion in Mares with Torsion of the Umbilical Cord

N. S. BARRON,
READING

Three thoroughbred mares out of a batch of ten, all of which were served about the same time and on the same premises, aborted without warning when seven and a half months pregnant. The second and third cases occurred within a short time of each other and a fortnight after the first. The three aborting mares were the first to be covered by a young, untried stallion but of the remaining seven, five produced full-time normal offspring whilst two proved to be barren.

The stud was well run, ample home-produced food being available. The mares had two acres of gently sloping paddock for daytime exercise, and a covered riding school when it was desirable to keep them in.

Clinical.—None of the mares concerned showed the slightest disturbance, neither running a temperature nor missing a single meal. The foetus and after-birth were expelled in the normal way perfectly cleanly and with no subsequent discharge. The foetuses showed no sign of decomposition, were fresh and sweet and could have died but very shortly before the act of abortion occurred. The only abnormality which was observed in two of the foals (the first was buried and not seen) was an extensively twisted umbilical cord. This was twisted more than 20 times and was swollen, oedematous and haemorrhagic (see photo). Blood samples were taken from the mares a few days after the abortions had occurred but all showed a very low titre (1/10 to 1/20) when tested against *S. abortivo-equinus* and were negative to *Br. abortus*. Cultures made from the heart-blood and stomach of one foal on a variety of media remained sterile.

Discussion.—The first abortion had been attributed to a severe shock but no evidence could be produced to support this hypothesis; moreover, a careful examination of the paddock showed no signs of a disturbance having occurred. The subsequent abortions caused considerable consternation and led to the recorded investigation. The existence of a lethal factor was considered though such is not known and in any case the fact that the five mares which carried to full time were not affected, whilst not completely vitiating this possibility, does not sustain it. The only positive finding was the extensive torsion of the umbilicus. When this was discussed with several people experienced in thoroughbred management the view was obtained that since the foal-foetus normally revolved freely some degree of twisting was to be expected. The cases under review were however admittedly exceptional in this respect. It is interesting to note that J. G. Wright* gives a table in which the number and degree of twisting of the allantoic and amniotic parts of the cord are recorded for six normal births. Only once were there as many as three twists, on three occasions there was one and in the remainder none, of one or the other structure.

In the absence of any other evidence it can only be concluded that the mares developed a preference for rolling and did so in one direction down the slope to such an extent that the umbilical cord became unduly coiled.

I should like to express my thanks for and appreciation of the interest taken and advice given by Mr. G. W. Searles, of Alresford, who originally drew my attention to this case.

* Wright, J. G. (1943.) *J. comp. Path.* **58.** 3.

ABSTRACTS

[Further Observations on the Caesarean Operation in the Bovine. Roberts, S. J., and Frank, E. R. (1942.) *Corn. Vet.* **32.** 395-9. (2 refs.).]

In 2½ years these authors have performed 58 Caesarean operations using an operative technique described by them in 1940 (see *Vet. Rec.* Abs. 1941, p. 583-4).

Of the 58 animals, 51 were first calf heifers, ten of which were between the ages of 13 to 18 months; seven were cows which had previously calved; 48 animals were Hereford or grade beef cattle.

Chief indications for the operation were: immaturity, juvenile genital organs and pelves, pelvic deformities, foetal monsters, foetal emphysema, indurated cervix and vagina, cervical non-dilatation, uterine torsion and hydrops.

Animals were divided into three groups according to whether their chances of survival were good, fair or poor. Taking the three groups together, which includes 17 subjects approaching extremis, the operation was successful in 57 per cent. of cases and 29·3 per cent. of the calves survived for more than 72 hours. Excluding patients with a definitely poor surgical risk, 77·7 per cent. recovered from the operation and 47 per cent. of their calves survived.

Of the 25 animals which died, death generally occurred in from 24 to 72 hours from metritis, toxaemia, septicaemia and peritonitis. Contributory causes were emaciation, exhaustion from protracted labour and lay interference.

It was found that the best recovery rate was in patients which had been in labour less than 18 hours.

Post-operative treatment consisted of the intravenous administration of calcium gluconate, physiological saline and dextrose. Uterine atony was corrected by pituitrin intramuscularly.

In cases of metritis and vaginitis, sulphanilamide was given regularly and Bipp used as a local dressing.

In two cases strangulation of bowel and peritonitis followed suture breakdown and in a third a small ventral hernia developed at the site of incision several weeks after operation.

C. F.

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[The Application of Physical Methods in the Treatment of Skin Diseases. Discussion: Sections of Dermatology and Physical Medicine, Royal Society of Medicine. *Proc. Roy. Soc. med.* (1943.) **36.** 423.]

During a discussion on the application of physical methods in the treatment of skin diseases by the Sections of Dermatology and Physical Medicine on March 18th, 1943, Dr. Rupert Hallam mentioned the lack of standardisation in the X-ray therapy erythema dose, and in discussing treatment of acne vulgaris by X-radiation referred to H. D. Niles' experience that there was just as great an improvement if only half the skin were treated. X-rays, Dr. Hallam said, should not be regarded as a short cut in skin treatment and in his experience the results of ultra violet radiation had been disappointing.

An analysis of cases treated at the Institute of Ray Therapy by ultra violet, visible and infra-red rays was given by Dr. William Beaumont, who reported improvement in a considerable percentage of many cases of acne vulgaris psoriasis, eczema, dermatitis, impetigo, herpes, tuberculous affections and even lupus vulgaris. Dr. R. T. Brain said he had not found many cases of psoriasis responding to irradiation alone nor was he impressed by the effects of ultra violet ray therapy alone, which did not bear comparison with the excellent results of X-ray therapy. He instanced the use of thorium X as a radio active substance for the production of superficial inflammation.

The disappointment in the treatment of psoriasis with ultra violet radiation mentioned by some speakers was not experienced by Dr. Bauwens, but he agreed with Dr. Beaumont as to lupus and cited the necessity of a deep reaction from the prolonged application of the Kroomayer ultra violet burner. Dr. Bauwens reported having once or twice obtained good results with zinc ionisation in impetigo and with ultra violet radiation locally in early cases of herpes zoster.

Experiences of the Physicotherapeutic Department of St. Mary's Hospital in the application of grenz rays (X-rays of long wave length, 3-1 Angstrom units) were summarised by Dr. Z. Leitner, who reported some favourable effects in puritus ani and vulvae, superficial types of acne vulgaris, naevus flammens, scleroderma, fresh keloids, plantar warts and well confined flesh lesions of lupus vulgaris. In commenting on Dr. Leitner's report Dr. W. N. Goldsmith said he had found grenz rays a boon in certain very common skin diseases, particularly in the form of eczema known as neuro-dermatitis and some forms of exogenous dermatitis or eczemas of the arms and hands apt to be called occupational

IN PARLIAMENT

Milk Sales (Restrictions)

The Minister of Food (Colonel Llewellin): With the permission of the House, I would like to make a short explanatory statement on Defence Regulation 55G, which has just been published. The policy of the Government in regard to "Measures to Improve the Quality of the Nation's Milk Supply" was set out in a White Paper published in July last. This regulation carries out that policy in so far as it is concerned with the control of the classes of milk sold in certain areas. The need for this control was fully explained in the White Paper.

The Regulation prohibits the sale of milk by retail in areas to be specified in Orders to be made by me, unless it is

either T.T. milk and in Scotland, certified milk
or accredited milk; in Scotland, standard milk, so long as in both these cases they are derived from a single herd;
or heat treated, pasteurised, or sterilised milk.

The areas which will be specified are those in which a rationalisation scheme is in force for economising the use of men and vehicles and thereby having the effect of restricting consumers in the choice of their dairymen. No area will be specified until I am satisfied that facilities exist for supplying adequate quantities of heat treated milk to meet the requirements of the area.

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Questions

Bulls (Licensing)

Mr. De la Bere asked the Minister of Agriculture whether, in view of the fact that all bulls on the farms throughout the country are now registered, he will, through the war agricultural county committees, or other suitable bodies, advise farmers who have no previous experience of keeping bulls as to the best methods of housing and exercising them, with a view to ensuring that the animals are not permitted to suffer unnecessarily through neglect, and also to provide for future healthiest possible herds.

Mr. Hudson: As indicated in the reply given on December 2nd to my hon. Friend the Member for Stourbridge (Mr. R. Morgan), livestock officers who inspect bulls for licence give general advice to owners in suitable cases on the care of bulls. County War Agricultural Executive Committees are also generally responsible for giving farmers all necessary advice about the care of livestock.

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Pedigree Stock Exports

Mr. De la Bere asked the Minister of Agriculture whether, in view of the fact that the expansion of the trade in the importation of pedigree cattle by Canada and the U.S.A. has been handicapped by fear in the importing countries of disease, he will make some pronouncement reassuring the importers and indicating the high standard of health of our pedigree stock throughout this country.

Mr. Hudson: The general standard of health of our pedigree stock is well known throughout the world. The fear that cattle brought from Great Britain might be responsible for introducing disease into Canada or U.S.A. applies almost entirely to foot-and-mouth disease and arises from the number of outbreaks of that disease which have been experienced in this country in recent years. To prevent any risk of that disease being carried by animals from this country to Canada, a quarantine station is maintained at Glasgow in which all cattle intended for shipment to Canada or U.S.A. *via* Canada are detained for 14 days prior to embarkation.

Mr. De la Bere asked the Minister of Agriculture whether he will confer with the President of the Board of Trade and his Export Group Branch with a view to assisting the breeders to expand their export of pedigree breeding stock at the earliest possible date after the conclusion of hostilities, and the desirability of having this branch of the export trade administered through his Department.

Mr. Hudson: The home market has always provided the main outlet for our pedigree stock and the restoration of our livestock industry after war-time reductions is likely to make that market of greater importance in the immediate post-war years. I do not, however, underrate the value of the export market, and this is a matter on which my Department is maintaining close touch with the Board of Trade.

Mr. De la Bere: Does not the Minister realise that the export market is more important and that it does not appear to be very much alive at the moment?

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Milk Containers (Cleanliness)

Mr. Leslie asked the Minister of Health whether he has considered a communication from the Sedgefield Rural District Council urging for legislation to settle a standard of bacteriological count for rinsings of churns, bottles, etc.; and what action he intends taking.

Mr. Willink: Yes, Sir. Under the Milk and Dairies Order, 1926, persons who empty and return churns in which milk has been delivered to them are required to cause the churns to be thoroughly cleansed before they leave their custody or control; and producers and other dairymen are required to cause all vessels used for containing milk to be kept in a state of thorough cleanliness. A considerable amount of bacteriological testing and advisory assistance in relation to the cleansing of churns is now being given under the National Milk Testing and Advisory Scheme, but I think that it would be premature to prescribe statutory bacteriological standards at the present stage.

Mr. Leslie: Will the Minister not agree that, in the interests of public health, this is a matter for attention?

Mr. Willink: It is receiving attention, but it is not easy to lay down bacteriological standards for cleansing every bottle.

Sir H. Williams: Are we to understand that the cleaners of bottles in future have to be bacteriologists, in order to count the number of bacteria?

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Feb. 5th.—General Meeting of the Association of Veterinary Inspectors, Central Station Hotel Glasgow, 2 p.m.

Feb. 16th.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, 1, Wimpole Street, W.1, 2.0 for 2.15 p.m.

Feb. 19th.—Meeting of the Society of Women Veterinary Surgeons at Liverpool, 2 p.m.

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Rations for Sick Animals

Arising out of the receipt of complaints by the Association that the procedure in the supply of rationed feeding stuffs for sick animals on farms varies in different localities, the Ministry of Agriculture has furnished the following statement designed to remove any misunderstanding on the part of members of the veterinary profession.

Where an owner is unable to obtain the bran or other feeding stuffs required for sick animals he can apply to the County War Agricultural Executive Committee, supporting his application if necessary by the production of a veterinary surgeon's certificate stating what kind and quantity of feeding stuffs are needed. That is the normal procedure, but to avoid delay where feeding stuffs are urgently needed traders in feeding stuffs in England and Wales are authorised by the Ministry of Food to supply up to 1 cwt. to a registered customer on presentation of a certificate signed by a veterinary surgeon. The quantity is limited to 1 cwt., since if more is required there is then sufficient time for the owner to approach the Committee direct for a supplementary supply, but it is desirable that veterinary surgeons should state in any such certificate the precise quantity, not exceeding 1 cwt. on any one occasion, of the prescribed commodity.

Traders forward such certificates to the appropriate Committee indicating whether the feeding stuffs have been supplied against coupons, or to a registered customer whose coupon account is exhausted. It is for the Committee to decide whether the feeding stuffs are to be regarded as part of the farmer's normal allocation or are to be additional, and in reaching a decision they take into account individual circumstances on the farm. This is necessary because in most cases the issue of rations is dependent upon need. Where the Committee decide that the feeding stuffs should be part of the farmer's ordinary rations no further action is taken by them, unless the farmer's coupon account with his trader is exhausted, in which case

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dermatitis. Although the characters of thorium X and grenz rays were different, their therapeutic indications overlapped to a certain extent, but both were particularly useful in those regions where the skin covered organs which deeper X-rays would damage. Dr. Goldsmith concluded by reference to the usefulness of sinusoidal current in the treatment of chilblains, erythrocyanosis frigida and the "blue leg" following infantile paralysis.

Dr. E. J. Crisp, in agreeing with Dr. Bauwens that adolescent acne was often due to endocrine deficiency, reported very successful treatment of young males by sunlight and antuitrin "S," a Parke Davis preparation. The possibility of antuitrin being effective without the sunlight was suggested.

G. C. K.

coupons equivalent to the issue are sent to the trader and a corresponding deduction is made from the next issue to the farmer. If, however, the Committee decide that the allowance should be additional to normal rations coupons are sent to the trader, and no adjustment is subsequently made in the farmer's future allowances.

The above arrangements do not apply to Scotland.

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Roll of Honour

Death on Active Service.—In a recent issue of *The London Gazette* the death on active service in Burma was announced of Lieut. James Lang, of the Royal Army Veterinary Corps. Deep sympathy is extended to Miss Lang, his next of kin, who is resident at his home, 6, Widford Grove, Chelmsford, Essex.

Lieut. J. Lang, B.Sc. (Vet. Sc.) (Edin.), M.R.C.V.S., R.A.V.C.

Brigadier G. A. Kelly writes : " Lieut. J. Lang qualified July 11th, 1942, at Edinburgh. He immediately volunteered for service in the Royal Army Veterinary Corps and was gazetted Lieutenant on September 2nd. He served with the Home Forces until May, 1943, when he was posted to India.

" He was an exceptionally able young officer with a most pleasant personality and his death is a great loss to us."

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The Late Dr. W. W. C. Topley

Personal Tributes

Mr. D. L. Hughes (Compton) writes :—

It came as a great shock to hear of the death of Dr. Topley, and as a former student of his I would like to pay a tribute to the memory of one who had a great influence on my life and thought.

It is perhaps a moot point whether Topley's contribution to science and medicine is greatest in the field of original work or as a teacher. His work in experimental epidemiology will long be a classic example of the analytical approach to the fundamentals of epidemiology. However, to those of us who had the inestimable privilege of attending his lectures and had contact with him later on committees, he will always be remembered as a great teacher.

His conduct of lectures for the Diploma in Bacteriology course was characteristic. Students were expected to have read the subject up thoroughly beforehand and the lecture became a discussion in which any one of us might be required to take up any particular point and argue in its favour, quoting all the relevant evidence from the literature.

His was an intellect which was absolutely honest and any doubtful hypothesis, any uncertain reasoning, received short-shrift. In the short time he was Secretary of the Agricultural Research Council he had already made great contributions to the direction of agricultural and veterinary research. In many ways his advent was like a breath of fresh air to work which was tending to become stale.

Veterinary research has lost a man who had its interests as a science really at heart.

Speaking personally, I shall never cease to be grateful for the influence of a man who could be called a true scientist.

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Dr. R. Lovell (Streatley) writes :—

Many people will be distressed at the passing of W. W. C. Topley, and for some of us a wise counsellor and friend has been taken from our midst. He will be remembered chiefly for his contributions to bacteriology, immunity and experimental epidemiology but those who worked with him intimately will remember him in other ways. As one who had this latter privilege for about nine years at the University of Manchester and at the London School of Hygiene and Tropical Medicine these profitable years will not easily be forgotten. The outstanding excellence of his laboratory technique and the careful planning of all his work impressed his pupils and colleagues. Those who entered his private laboratory towards the end of the working day would find his bench clear with the exception of a few necessities. One would hear his voice dictating the results of the examination of slides or of agglutination tests. The tidiness, the cleanliness and the care in his work portrayed the orderly mind which he brought to bear on all his activities. There are other memories ; the trail of cigarette ash as he visited his colleagues, the charts in his room which he studied even when wiping his hands on a towel, the laboratory teas when conversation sparkled—not always bacteriological in flavour.

It is not possible to estimate the influence he has wielded in the veterinary sphere even before he was connected with the Agricultural Research Council. He set a high standard in his teaching as well as in his research work. His dictum that the " grammar " of his science must be studied and understood before progress can be made has never left one and is an example of the truth that those who would pick the bloom of things must first dig amongst the roots. His pupils, of whom a proportion are veterinary surgeons, are scattered throughout this country and the Colonies, and his stimulating personality will live in their minds. He taught us much, encouraged us and to those who were his colleagues he taught how to teach ; for this and for much more we express our gratitude.

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R.C.V.S. OBITUARY

Golding, Walter Wyndham, J.P., M.R.C.V.S., Upton House, Hertford. Graduated London, December 21st, 1895. Died January 21st, 1944; aged 69 years.

Mr. Walter W. Golding, J.P., M.R.C.V.S.

The many members of the profession who, knowing him, held him in high esteem, will regret to learn that Mr. Walter W. Golding, M.R.C.V.S., of Upton House, Hertford, died on Friday, January 21st, after a short illness, in his 70th year. Born at Haywards Heath, he was the fourth son of the late Mr. Charles Golding, and practised as a veterinary surgeon for many years at Hertford, but retired some few years ago. He was a Town Councillor for a short time and Borough Magistrate for some years up to the time of his death. In 1911 he married the youngest daughter (Miss Ada M. Bradford) of the late Sir James and Lady Bradford, of Oaklands, Haywards Heath. He leaves a widow, one son and two daughters, with whom deep sympathy is felt in their great loss.

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PERSONAL

Forthcoming Marriage.—Heeley—Terry.—The engagement is announced between Denis M. (Tim.) Heeley, M.R.C.V.S., eldest son of Mr. and Mrs. E. H. Heeley, Bearsted, Kent, and Kay, youngest daughter of Mr. and Mrs. A. E. Terry, of East Court Farm, Gravesend, Kent.

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NUTRITION AND REPRODUCTION IN FARM ANIMALS

The following conclusions are drawn to a succinct report written on the above subject by the Committee on Animal Nutrition, National Research Council, Washington, D.C., U.S.A. (see *J. Amer. Vet. Med. Ass.* **(1943.) 103.** 386).

" (1) It has been repeatedly demonstrated that nutrition is directly and specifically related to reproduction of farm animals.

" (2) Ample energy is necessary for normal reproduction. Unless a restricted ration is fed, a ration which supplies sufficient energy will supply ample quality and quantity of protein for cattle. Swine require supplementary protein for the usual farm rations. Protein of animal origin or from good quality green legume hays, such as alfalfa fed in liberal amounts, will adequately fortify the swine ration.

" (3) Dietary phosphorus, calcium, iron, iodine, and manganese have been shown to be essential for successful reproduction of farm animals.

" (4) *Vitamin A* is an indispensable dietary factor for reproduction. Its presence is necessary in more than minimal amounts. Growing, healthy calves require 18 microgrammes of vitamin A per kg. of body weight per day in order to maintain an adequate blood plasma vitamin A content of 10 microgrammes per 100 c.c. of blood plasma. Dairy cattle require a blood plasma vitamin A level of 15 microgrammes or more per 100 c.c. if they are successfully to maintain milk production and reproduction.

" (5) *Vitamin C*, or ascorbic acid, administration has been shown to have a direct stimulatory effect upon sterile males and ' shy-breeding ' females. It, too, is an indispensable factor for successful reproduction. Unlike vitamin A, where the entire source is exogenous, farm animals synthesise their own ascorbic acid and *require the added vitamin only when their own synthetic powers fail to provide ample amounts.* Therefore, its use is limited to the occasional animal. It can be fed to animals with single stomachs, but it must be subcutaneously injected into ruminants. The anaesthetic drug, chloretone, can be fed to ruminants to effect a rise in blood plasma ascorbic acid. However, its use should be attempted only under the direction of a qualified veterinarian.

" (6) There is no convincing evidence that the addition of extra vitamin E to normal rations has a direct or specific effect upon reproduction in practical herd and flock management.

" (7) Certain as yet unidentified dietary factors are required for successful parturition and suckling of young pigs by sows fed certain practical rations. Alfalfa hay, tankage, or fish meal, were found to be effective supplements to such rations."

Although the above summary of the nutritional relationships of the reproductive function gives undoubtedly a very fair survey of this particular aspect, it will not be overlooked by the veterinary reader that an understanding of the proper working of the reproductive system involves some acquaintance with several other fields of study.

J. T. E.

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NATIONAL FARMERS' UNION PRESIDENT

Mr. J. K. Knowles, Vice-President, was elected this year's President of the National Farmers' Union at a Council meeting held in London recently, and Mr. J. Turner Vice-President.

Mr. Knowles has been Vice-President since October last, when he was elected after the death of Captain George Deakin. Aged 40, he lives at Moor Farm, Morley, Derbyshire. He is the second youngest President to be elected. Mr. Turner, who farms at South Amston, Sheffield, has been for two years a Council delegate for Nottinghamshire.

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"*In Memoriam*": *A Correction.*—It is regretted that a slight error was made in the composite tribute by Dr. J. T. Edwards which was published in the issue of *The Veterinary Record* of January 22nd, in that the last Major-General R.A.V.C. was not, as therein stated, W. S. Anthony, C.B., C.M.G., but J. J. B. Tapley, D.S.O., the late General Anthony being the penultimate holder of that rank.

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Royal Society of Medicine.—The next meeting of the Comparative Medicine Section of the Royal Society of Medicine will be held at the Society's House, 1, Wimpole Street, London, W.1, on Wednesday, February 16th, at 2 for 2.15 p.m. The series of meetings this session has one theme: "The Limitations and Uses of the Comparative Method in Medicine," and in his presidential address Dr. J. T. Edwards surveyed the general field. At the December meeting the subject was dealt with from the angle of Animal Ecology and Genetics and a helpful and stimulating discussion was developed. The next meeting concerns Nutrition and Endocrinology and the opening speakers are Dr. H. H. Green and Dr. S. J. Folley. It is hoped that readers of *The Veterinary Record* will accept this invitation to attend and, if they feel disposed, to join in the discussion.

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MINISTRY OF AGRICULTURE NEWS SERVICE

Artificial Insemination.—Two questions about artificial insemination have recently been asked in the House of Commons. One was whether the various stock-breeding societies are co-operating with the Ministry of Agriculture in the promotion of this practice and which societies are averse to it. The Minister of Agriculture, Mr. R. S. Hudson, explained that at this early stage the Department is controlling rather than promoting the practice and said that the attitude generally of the cattle breed societies is one of caution rather than of aversion.

In reply to the second question, the Minister said that under the Regulations for the control of this practice, which came into operation on November 1st last, four licensed stations, including the two experimental stations at Cambridge and Reading, are now in operation, and applications for licences for several other projected stations are under consideration. Mr. Hudson added that two British experts are at present in the U.S.A., on behalf of the Agricultural Improvement Council, studying the development of artificial insemination in that country.

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A Question of Milk.—There has been no abnormal drop in milk supplies. During the year ended December 30th, 1942, sales were greater than in any other war year. This was the answer given by Mr. R. S. Hudson, Minister of Agriculture, in the House of Commons, when he was asked whether he was aware that a considerable number of milk producers were changing from milk production to other forms of farming, owing to continued changes of regulation and interference by Government Departments.

Mr. Hudson also said that he had no evidence to suggest that a considerable number of milk producers were giving up milk production.

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An Old Custom Revived.—On the upland farms of Wales temporary leys are being stocked with cattle agisted from the lowlands. This is not a new idea but a revival of an old Welsh custom that had died out. The procedure is simple. The lowland farmer sends his cattle up to the hills in the summer for five months, and for this he pays £3 per head. That means that with the subsidy the hill farmer receives £6. Preference is given to the dairy farmer. With young and dry stock off his farm, he is able to make better provision for winter food by devoting larger areas to hay, green crops or silage, and also has more land on which to grow human foods, such as potatoes, wheat and barley. The scheme was first tried out this summer and about 600 cattle were sent up to the hills. It has the advantage that the hill farmer knows exactly where he stands.

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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TUBERCULOUS MASTITIS—SOME SURVIVING FALLACIES

Sir,—In *The Veterinary Record* of December 4th, 1943, p. 470, Mr. Thornton suggests that the probable method of infection of the udder with tuberculosis is the route suggested by M'Fadyean 27 years ago, namely, by lymphatic extension from the peritoneum. It is very surprising that this view does not appear to have been challenged by anyone (as reported) discussing the paper.

There appears to be no evidence to support this "retrograde lymphatic flow" theory except the occasional co-incident occurrence of tuberculous peritonitis and (supra-mammary) lymphadenitis with tubercle of the udder. The great mass of *post-mortem* evidence suggests that infection of the udder with tuberculosis is almost invariably by the blood stream—namely, the presence of haematogenous lesions of comparable age in other organs such as the lungs, uterus and/or kidneys, and the frequent absence of tuberculosis in the supra-mammary gland and peritoneum. Furthermore, the lesions of tuberculosis of the udder are generally mostly found in early cases above and around the base of the teat and not in the neighbourhood of the lymphatic gland.

In the past few days a further misconception of the pathogenesis of tuberculosis of the udder has come to my notice in a paper by E. J. Pullinger in the *Journal of the South African Veterinary Medical Association*, December, 1942, in which Pullinger takes as presumptive evidence of tuberculous mastitis the presence of tuberculosis in the supra-mammary gland. This theory is unlikely to find credence among those with experience of routine examination of dairy cattle controlled by the biological testing of herd milk samples for tubercle bacilli. Such experience shows that cases of gross tuberculosis of the supra-mammary lymphatic glands may occur although the milk is free from infection with tubercle bacilli, as assessed by the biological test. It may be noted that Pullinger, quoting an earlier investigation of his own (*The Lancet*, 1934, **1**, page 967), assumes the reliability of this test as he states "the milk of tuberculous cows was diluted one million times without loss of infectivity for guinea-pigs." A certain number of such cases of gross tuberculosis of the supra-mammary gland has been watched for prolonged periods with the milk remaining negative.

Post-mortem experience shows that the supra-mammary lymphatic glands can only be expected to show evidence of tuberculosis after a rather prolonged presence of disease in the udder, or by infection *via the* blood stream independent of the udder as indicated above. The writer believes that multiple tuberculous infection of the carcase lymph glands (including the supra-mammary) is frequently congenital in origin—development of the lesions not always having occurred progressively during youth.

The path of infection in udder tuberculosis and the absence of tubercle bacilli in the milk of cows with gross tuberculosis of the supra-mammary glands but without disease of the udder was well discussed so long ago as 1937 by H. L. Torrance (*Vet. Rec.*, **49**, 1441, Nov. 13th). The general pathogenesis of tuberculosis in animals according to the Nieberle School was fully propounded by J. R. M. Innes in the same year (*V.R.*, **49**, 783, June 27th), and quite recently tuberculosis of the udder was thoroughly dealt with by J. F. Stamp (*J. comp. Path.*, **53**, 220 April, 1943). Unfortunately, this work does not appear to have been accorded the recognition it deserves—as indicated by the perpetuation of such fallacies in the literature.

Yours faithfully,

"Woodside," J. S. Steward.
Hilltop Avenue, Wilmslow.
January 19th, 1944.